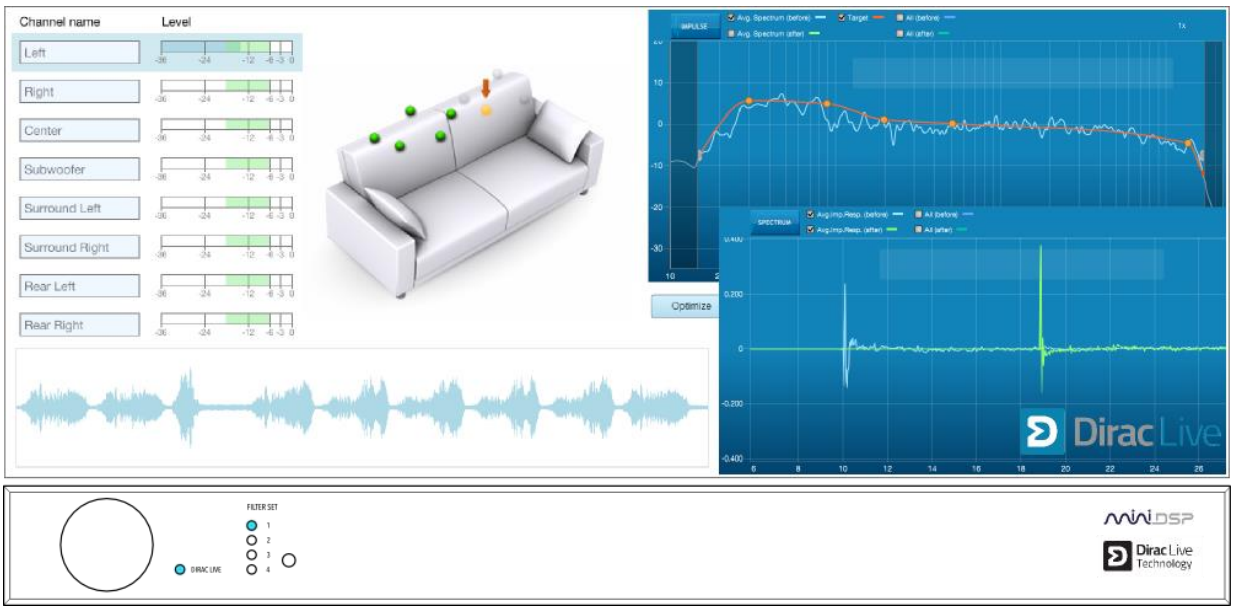
DDRC-88A

8-CHANNEL AUDIO PROCESSOR

WITH DIRAC LIVE® TECHNOLOGY

User Manual

PRELIMINARY AND SUBJECT TO CHANGE



Revision history

Revision	Description	Date
0.1	First draft	25 November 2014
0.2	Preliminary pre-release version	5 December 2014

TABLE OF CONTENTS

IMPORTANT INFORMATION

Please read the following information before use. In case of any questions, please contact miniDSP via the support portal at minidsp.desk.com.

SYSTEM REQUIREMENTS

To configure your *DDRC-88A* audio processor, you will require a Windows PC with the following minimum specification:

- Intel Pentium III or later, AMD Athlon XP or later
- 2 Gigabytes (GB) of RAM or higher
- Keyboard and mouse or compatible pointing device
- Microsoft• ® Windows® Vista® SP1/Win7/Win8
- Microsoft• ® .NET framework v3.5 or later
- Two free USB 2.0 ports

DISCLAIMER/WARNING

miniDSP cannot be held responsible for any damage that may result from the improper use or incorrect configuration of this product. Please read this manual carefully to ensure that you fully understand how to operate and use this product, as incorrect use or use beyond the parameters and ways recommended in this manual have the potential to cause damage to your audio system.

Please also note that many of the questions we receive at the technical support department are already answered in this User Manual and in the online application notes on the miniDSP.com website. So please take the time to carefully read this user manual and the online technical documentation. And if an issue arises with your unit, please read through the Troubleshooting section first. Thank you for your understanding!

WARRANTY TERMS

miniDSP Ltd warrants this product to be free from defects in materials and workmanship for a period of one year from the invoice date. Our warranty does not cover failure of the product due to incorrect connection or installation, improper or undocumented use, unauthorized servicing, modification or alteration of the unit in any way, or any usage outside of that recommended in this manual. If in doubt, contact miniDSP prior to use.

FCC CLASS B STATEMENT

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Warning: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Notice: Shielded interface cable must be used in order to comply with emission limits.

Notice: Changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

CE Mark Statement

The DDRC-88A has passed the test performed according to European Standard EN 55022 Class B.

Package Contents

Your *DDRC-88A* package includes:

- One *DDRC-88A* audio processor
- One universal 12 VDC power supply
- One USB cable for computer connectivity (1.5m)
- One full license for **Dirac Live Calibration Tool for miniDSP**

A Note on this Manual

This User Manual is designed for reading in both print and on the computer. If printing the manual, please print double-sided. The embedded page size is 8 ½" x 11". Printing on A4 paper will result in a slightly reduced size.

For reading on the computer, we have included hyperlinked cross-references throughout the manual. In addition, a table of contents is embedded in the PDF file. Displaying this table of contents will make navigation much easier:

- In Adobe Reader on Windows, click on the "bookmarks" icon at the left. The table of contents will appear on the left and can be unfolded at each level by clicking on the "+" icons.
- In Preview on the Mac, click on the **View** menu and select **Table of Contents**. The table of contents will appear on the left and can be unfolded at each level by clicking on the triangle icons.

1 PRODUCT OVERVIEW

Thank you for purchasing a *DDRC-88A* audio processor powered by Dirac Live®, the world's premier room correction solution. We are delighted to offer you this software and hardware combination, the fruit of extensive research and development and years of experience in sound system tuning.

The *DDRC-88A* is an 8-channel digital audio signal processor (DSP) running the Dirac Live® room correction algorithm. The onboard floating-point SHARC processor allows full time and phase correction of a 7.1 home theater or multichannel audio system. Inputs and outputs are analog, available as both single-ended signals connected via RCA jacks, and as balanced signals via Phoenix terminal blocks.

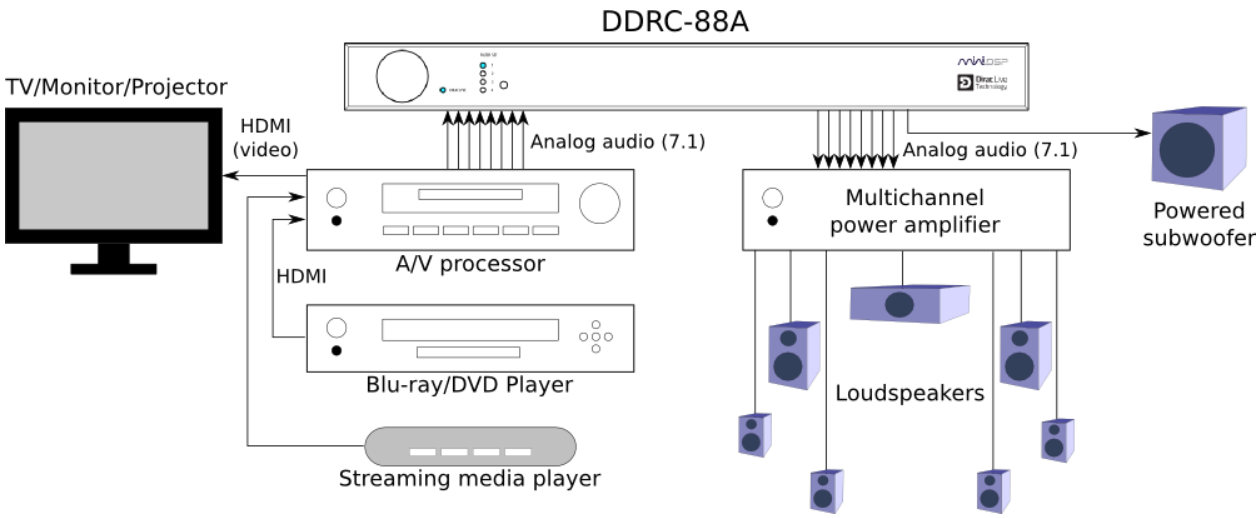
The DDRC-88A is one of the products in the miniDSP *Home Theater Series* of audio processors. Deploying a *DDRC-88A* processor in a home theater system will:

- Improve imaging and immersion
- Improve clarity of music and dialog
- Produce a tighter bass
- Reduce listening fatigue
- Remove resonances and room modes

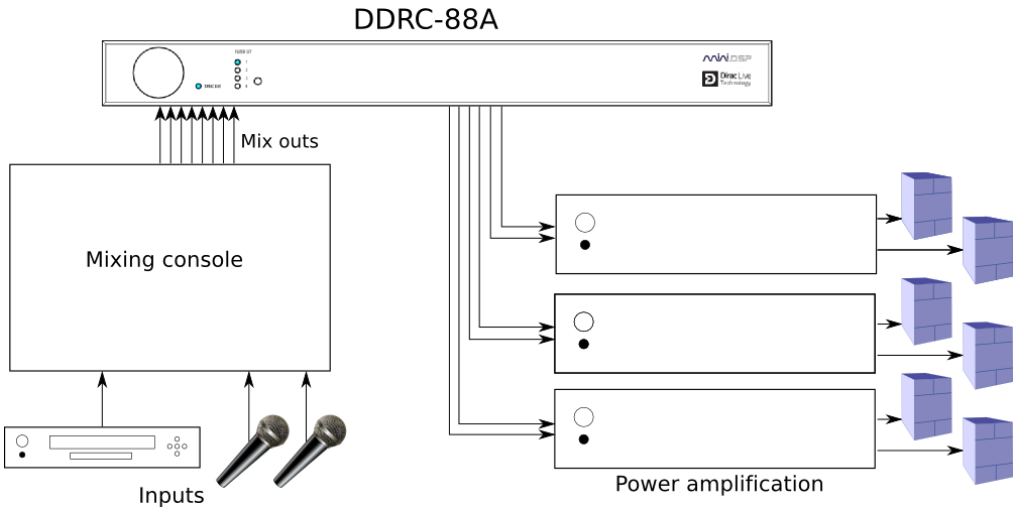
While typical usage is for home theater, the DDRC-88A can be used anywhere an 8-channel room correction processor is required, such as recording and mastering studios, drama theaters and performance venues, places of worship, and so on.

1.1 TYPICAL SYSTEM CONFIGURATION

The DDRC-88A is inserted between line-level analog sources and power amplification. In home theater applications, signal to the DDRC-88A typically comes from an A/V processor (AVP) with one or more source devices, and the amplification is typically a multichannel power amplifier. A source such as a Blu-ray player with multichannel analog outputs can also be connected directly to the DDRC-88A.



In sound reinforcement applications, the DDRC-88A is typically connected between a mixing console and power amplification, as shown below. Individual channels can be set for either full-range or subwoofer operation.



Computer connectivity is used to perform acoustic measurements and generate digital room correction filters. Up to four sets of correction filters can be stored on the *DDRC-88A* processor and recalled from the front panel or via an infrared remote. Once the processor is fully configured, the computer is no longer needed.

1.2 How Dirac Live® works

The miniDSP *DDRC-88A* audio processor includes Dirac Live®, a premium mixed-phase room correction technology. This technology is used not only in home stereo and home theater systems but also in cinemas, recording studios, and luxury cars.

As with any room correction system, Dirac Live® corrects the system's *magnitude response* (often referred to imprecisely as "frequency response"). In contrast to fully automated systems, Dirac Live® corrects the magnitude response towards a user-adjustable *target response*. The target response takes account of the natural frequency range of the loudspeaker system and the normal effects of loudspeaker dispersion on the measured *in-room* magnitude response.

In addition, Dirac Live® corrects the system's *impulse response*, which reflects how the system responds to a sharp transient such as a drumbeat. Reflections, diffraction, resonances, misaligned drivers, and so on, all combine to smear out the transient. An ideal loudspeaker has none of these, so correcting the impulse response makes the speaker in the room behave much more like that ideal loudspeaker. The impulse response is a critical factor for accurate sound-staging, clarity and bass reproduction. Dirac Live® employs a sophisticated analysis algorithm to make the optimal correction across the *whole* listening area, not just at a single point.

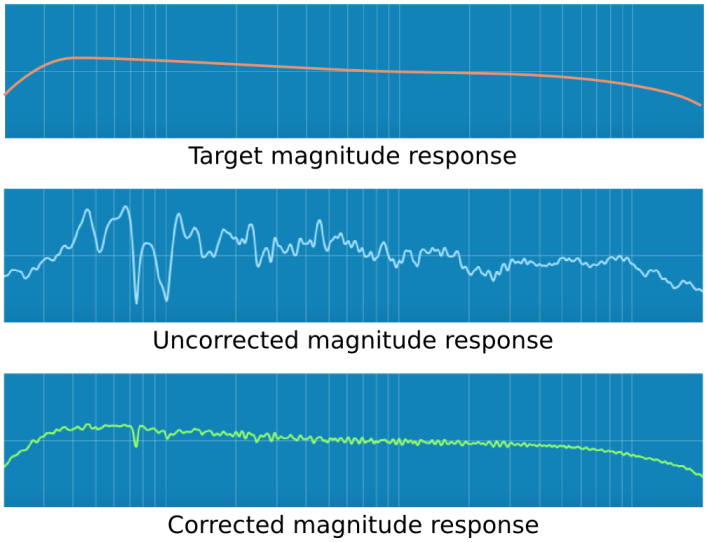


Illustration of Dirac Live® magnitude response correction

Dirac Live® accomplishes this using *mixed-phase filters* – filters that match a desired magnitude response *and* generate a customized impulse response. This contrasts with the *minimum-phase* and *linear-phase* filters that are commonly used in audio applications. While minimum-phase and linear-phase filters are relatively easy to design, they are tightly constrained in their impulse response characteristics – neither can make a desired change to the magnitude response independently of controlling the impulse response. In some cases, they may even make things worse.

Mixed-phase filters are more difficult to design, but the audible performance of Dirac Live® is due to its success in using mixed-phase filters to make the system response across the *whole* listening area more closely resemble that of an ideal speaker. The energy from the direct wave and from early reflections is optimally combined to arrive as a single wavefront to the listener. Late reflections are left largely untouched, being corrected only for their spectral coloration, as they contribute to a larger, more enveloping soundstage.

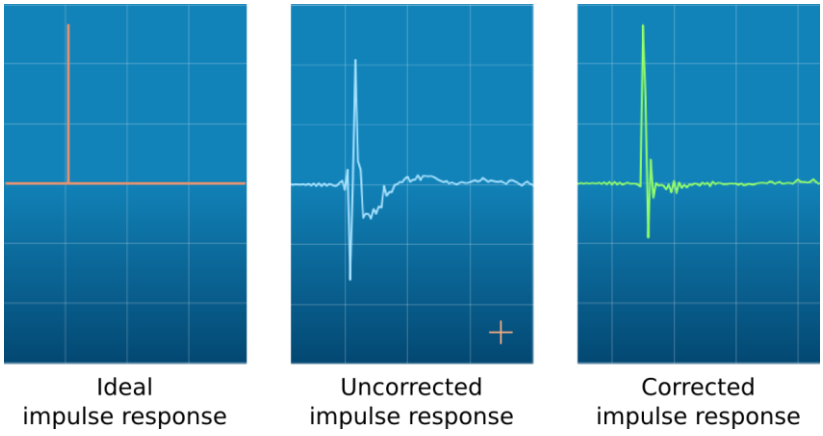
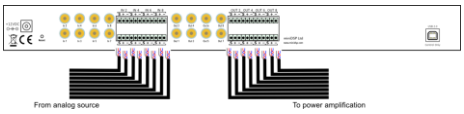


Illustration of Dirac Live® impulse response correction

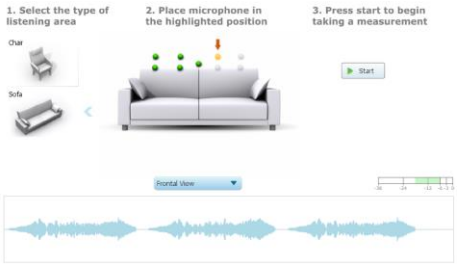
1.3 DDRC-88A / DIRAC LIVE® CONFIGURATION STEPS

The steps for configuring the *DDRC-88A* audio processor with Dirac Live® to optimize your home theater system is summarized as follows:

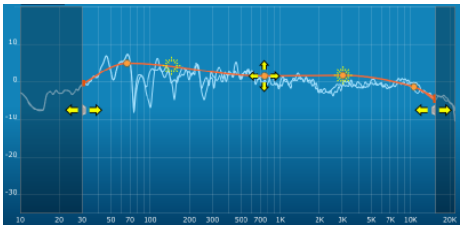
1. Connect the *DDRC-88A* audio processor into your system and install software. See Section 2, Installation and Setup.



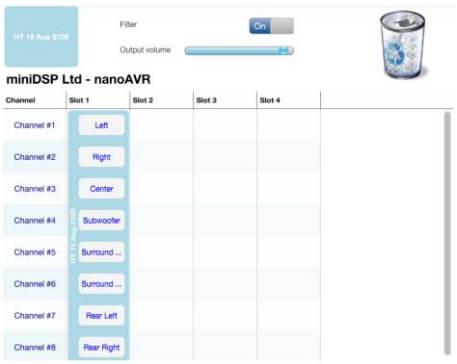
2. Run a series of acoustic measurements using the **Dirac Live Calibration Tool For miniDSP** program, to capture the acoustic behavior of your speakers and room. See Section 3, Acoustic Measurement.



3. Generate digital room correction filters that will be executed by the *DDRC-88A* processor. Up to four filter sets can be downloaded into the processor for easy real-time recall and auditioning. See Section 4, Filter Design.



4. Once the digital room correction filters are designed and downloaded, the computer can be disconnected, as computer connectivity is not required for normal listening. See Section 5, Using the DDRC-88A audio processor.



2 INSTALLATION AND SETUP

2.1 SOFTWARE INSTALLATION AND LICENSE ACTIVATION

PRELIMINARY AND SUBJECT TO CHANGE

2.1.1 Framework installation

Prior to installing the software, download and install the following frameworks. You will need to accept the license agreements in order to successfully complete the installation. If you haven't updated these recently, check that you have the latest versions prior to running the miniDSP install programs.

- Microsoft .NET framework (version 3.5 or later)
- Latest version of Adobe Flash
- Latest version of Adobe Air
- Microsoft Visual C++ 2010 Redistributable Package: for x86 (32-bit operating system) or x64 (64-bit operating system).

2.1.2 Software installation

When you receive notification that your order has shipped, your installation software downloads will be available at the *User Downloads* section of the miniDSP website, under the *DDRC-88A* heading.

http://www.minidsp.com/userdownloads

Download two installation zip files: the **Dirac Live Calibration Tool for miniDSP**, and the **DDRC-88A Utility** program. Unzip each file and double-click to run each installer. Follow the on-screen instructions to complete installation.

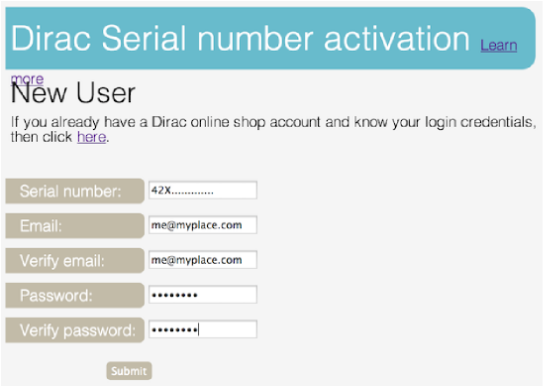
2.1.3 License activation

1. Start the miniDSP **DDRC-88A Utility** program. It will appear as shown on the left below.
2. Connect your *DDRC-88A* processor to your computer via USB, then click on the **Connect** button. It will change to a green tick.
3. Click on **Get Activation Serial Number**. The program will get your unique serial number from the connected DDRC-88A and display it, as shown on the right below.

4. Using this serial number, activate your license on the miniDSP Dirac Live activation page:

   http://www.minidsp.com/dirac-series/activate/#activate

If you have not purchased a Dirac Live license before, use the **New User** screen on the left. If this is not your first Dirac Live license, use the screen on the right.

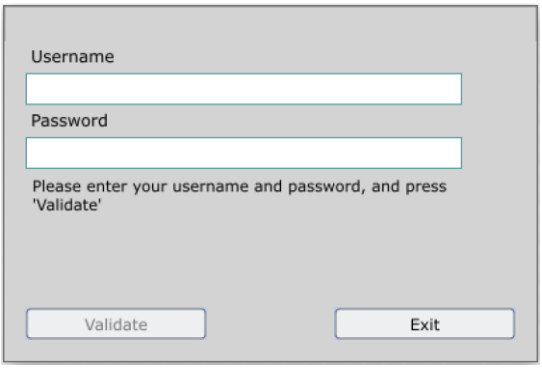


Notes:

1. The serial number that must be entered in the activation screen is **not** the serial number printed on the hardware unit. A unique serial number specific to Dirac Live is programmed into the firmware of each unit and can only be accessed with the **DDRC-88A Utility** program (step 3 above).
2. The email address and username used during license activation and validation are not related to your user account on miniDSP.com. To activate and validate a Dirac Live license, you must create an account on the Dirac server using the form shown at left in step 4 above.
3. If you purchase more than one *DDRC-88A* or *Dirac Series* processor, each will need to be activated with its unique serial number. Use the form shown on the right in step 4 above and enter the serial number of each additional processor, and they will in turn be added to your license.

2.1.4 License validation

Start the **Dirac Live Calibration Tool For miniDSP** program. It will ask you to validate your software license. Enter the email address and password that you used when activating your license, and then click on **Validate**:

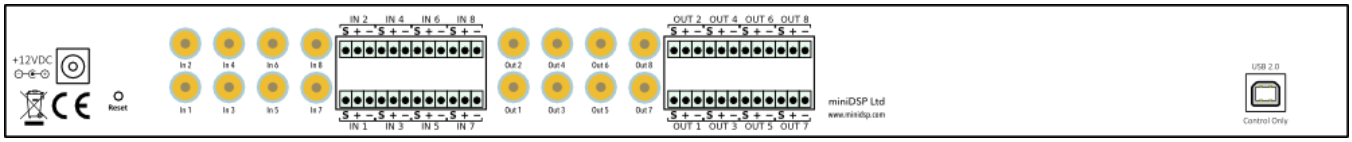


You will need to be connected to the Internet to validate your license. Any active firewalls will need to have HTTP (normal web traffic) enabled.

The **Username** in the validation screen must be the *email address* that you used in the activation screen above. It is not your miniDSP website username.

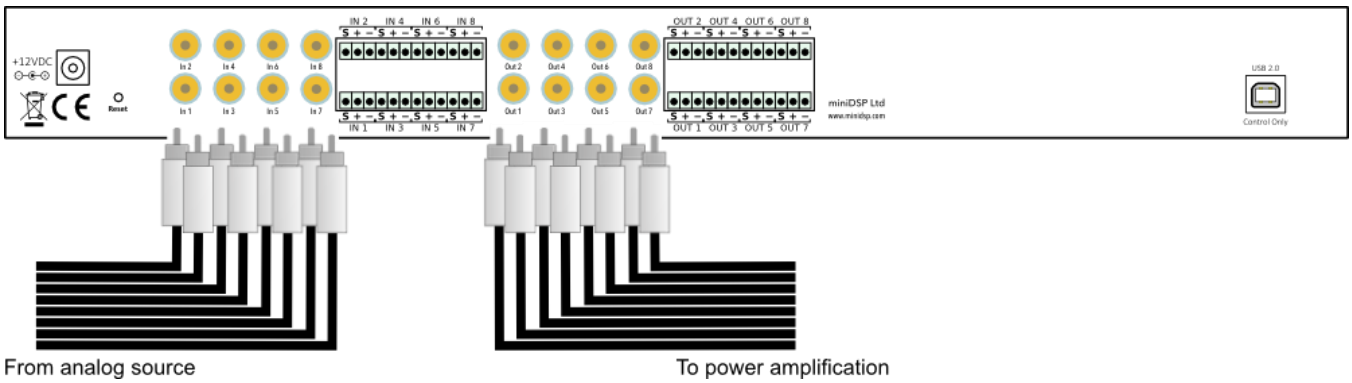
2.2 HARDWARE CONNECTIVITY

All connections to the DDRC-88A are made on the rear panel.

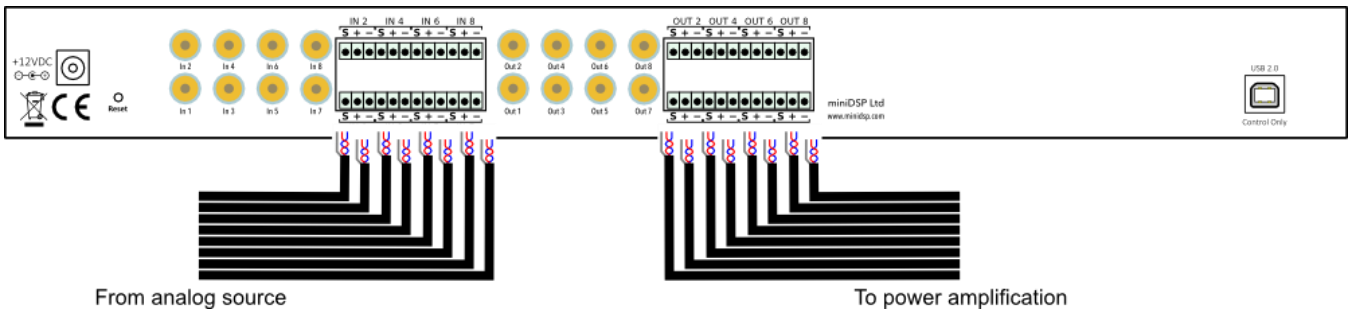


2.2.1 Analog input and output

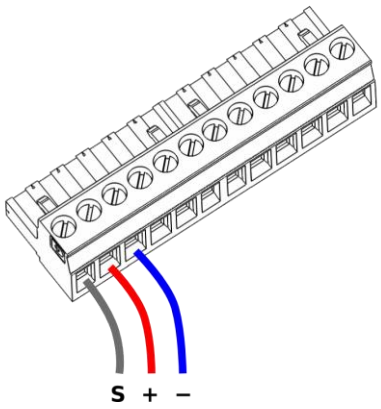
Up to eight channels can be connected to the DDRC-88A. Single-ended connections are made directly to the RCA jacks.



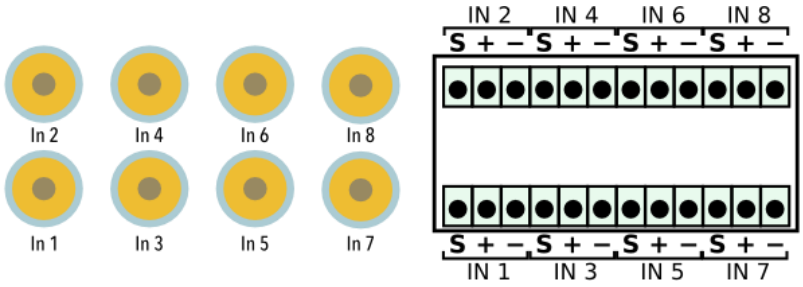
Balanced connections are made by connecting stripped wire ends directly to the Phoenix terminal blocks.



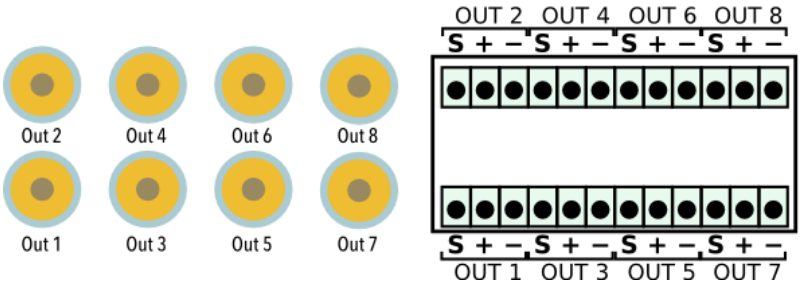
Individual wires from the shielded pair cable are connected to each set of terminals as shown:



Ensure that inputs and outputs are connected to the correct jack or set of terminals, or confusion will result when configuring the processor. This diagram shows the channel numbering on the rear panel. For information on input and output gain adjustments, see Optimizing gain structure.



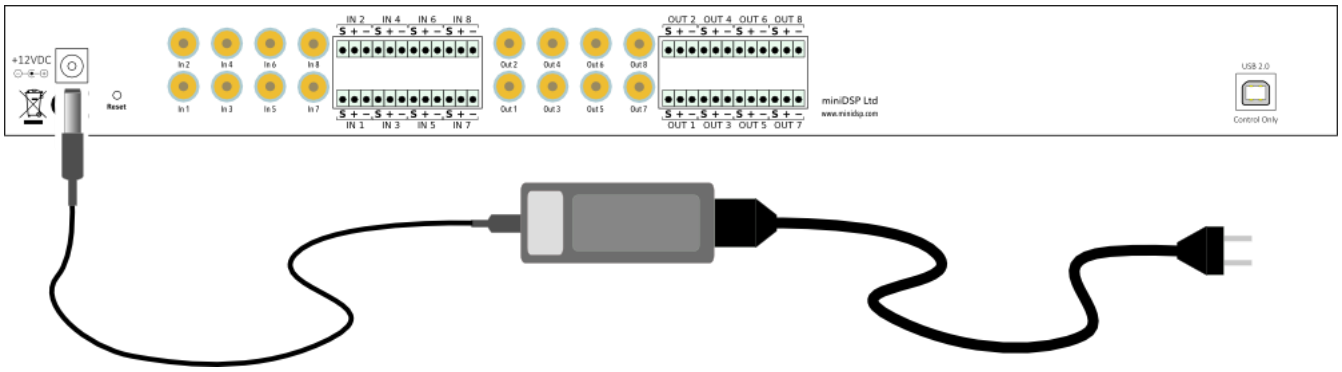
INPUTS. Connect either single-ended (RCA) or balanced. If input jumper sensitivity is set to 0.9V, connect only single-ended (RCA).



OUTPUTS. Connect single-ended (RCA), balanced, or both. This applies regardless of output gain switch setting.

2.2.2 DC Power

Fit the supplied IEC cable to the 12 VDC power supply. Plug the DC connector into the **+12VDC** socket on the rear panel of the DDRC-88A, and then plug the AC mains plug into the power outlet.



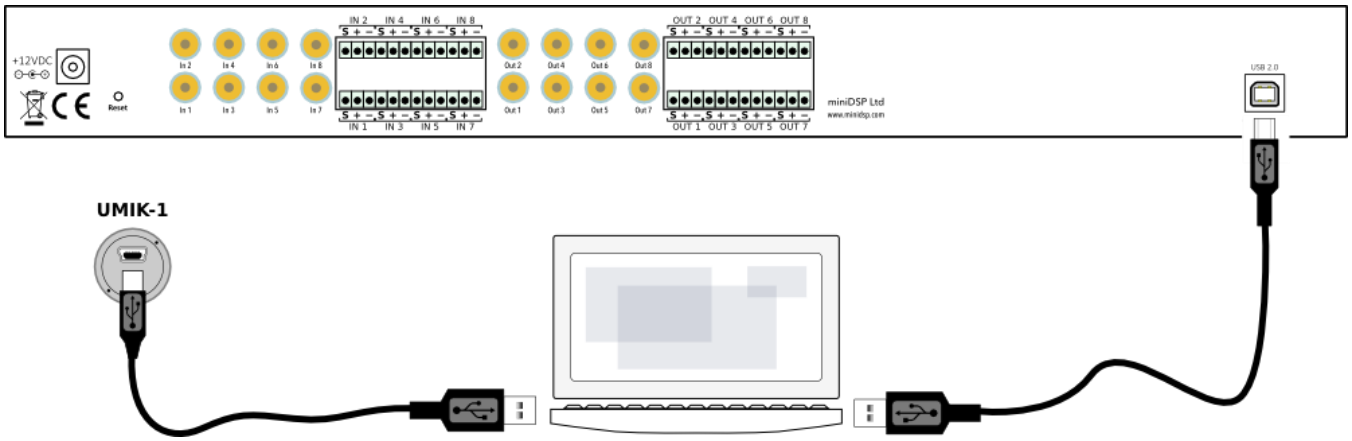
Apply power only after all analog input and output connections have been made. It is also strongly recommended that power amplification be powered on *after* all other equipment.

2.2.3 USB

To configure the DDRC-88A using **Dirac Live Calibration Tool for miniDSP**:

- Connect the USB port of the DDRC-88A to a USB 2.0 port on your computer using the supplied cable
- Connect a miniDSP UMIK-1 to a second USB port on your computer.

Note: the miniDSP UMIK-1 is the only measurement microphone that can be used with the *DDRC-88A* and **Dirac Live Calibration Tool for miniDSP**.

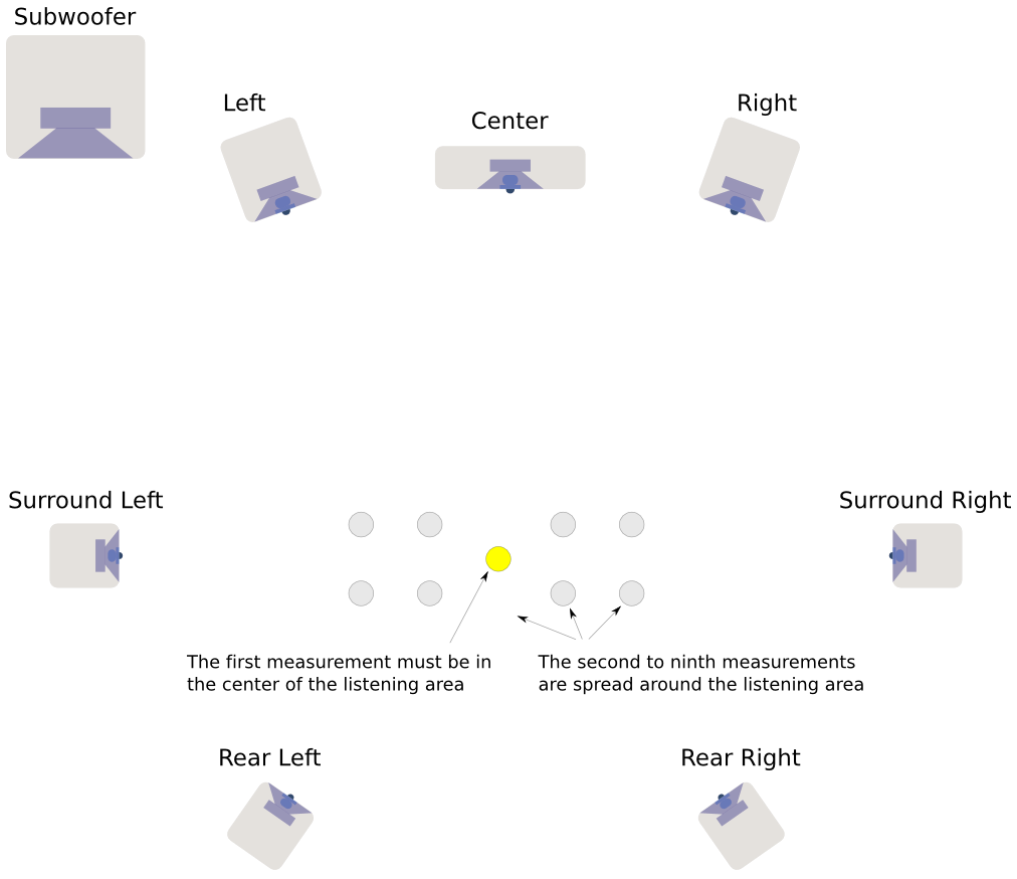


3 ACOUSTIC MEASUREMENT

The **Dirac Live Calibration Tool For miniDSP** uses a set of measurements made in your listening room to gather all the acoustical information about your room and speakers that it needs to calculate the correction filters. The measurements are made using the *DDRC-88A* processor and a miniDSP UMIK-1 measurement microphone (must be purchased separately).

3.1 LOUDSPEAKER AND MICROPHONE POSITIONING

Prior to performing acoustic measurements, loudspeaker and subwoofer positioning should be optimized. In a home theater setting, the location of the subwoofer within the room will have a large impact on the smoothness of bass response. With Dirac Live®, you have more freedom with loudspeaker and subwoofer placement, but the best result will still be achieved if optimal placement is used together with Dirac Live®.



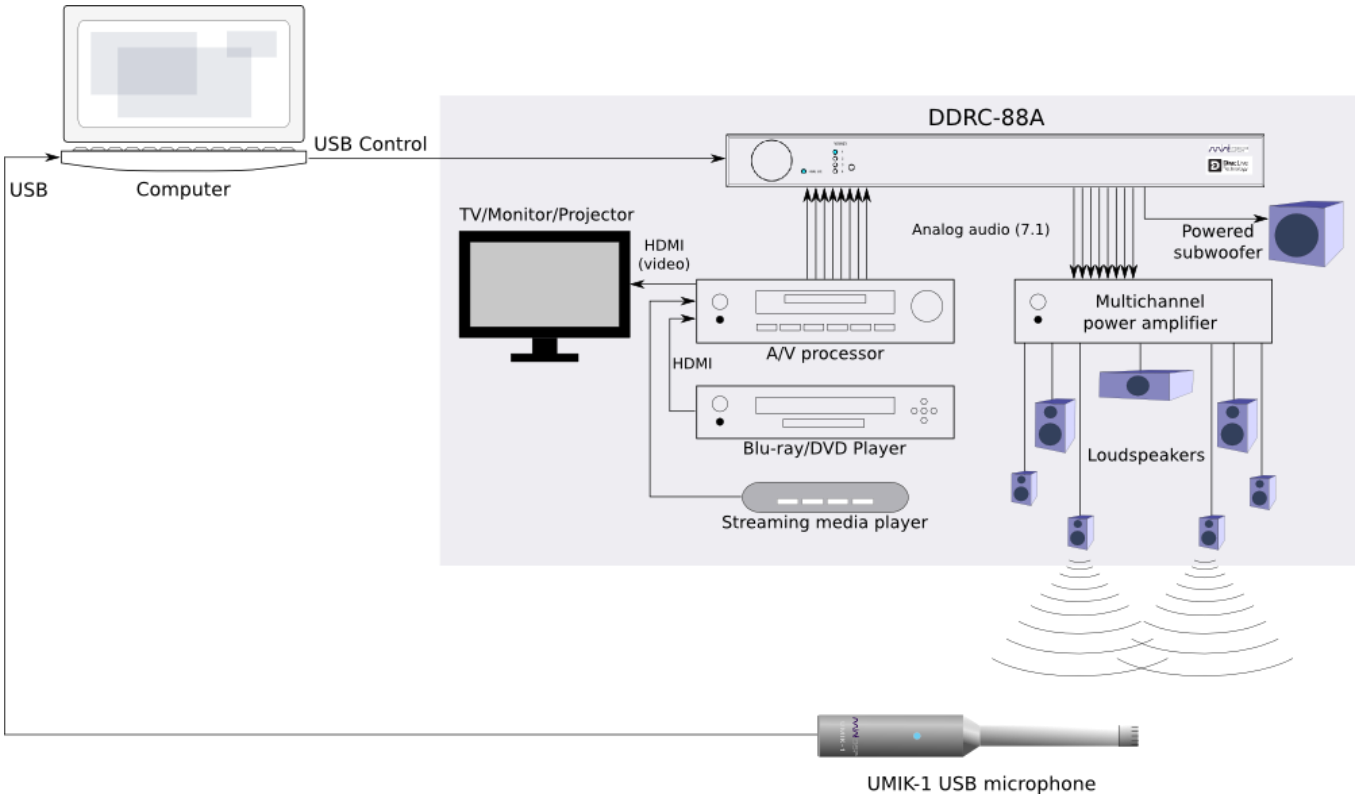
Typical home theater measurement setup

A total of nine measurements are needed, with the microphone located in different positions in the room and pointed vertically (that is, at the floor or ceiling). The first measurement must be taken at the central location of the listening area, as this location sets the levels and delays of each speaker. Eight more measurements are then taken at locations spread around the listening room and at different heights from the floor.

3.2 CONNECTIONS FOR ACOUSTIC MEASUREMENT

The figure below shows a typical connection diagram for performing acoustic measurement. No changes to the audio connections are needed. Simply:

1. Connect the supplied USB (type A to type B) cable from the DDRC-88A to a USB port on the computer.
2. Connect a USB cable (type A to mini type B) from the UMIK-1 to a USB port on the computer.



Place the UMIK-1 microphone into a microphone stand and position the computer and cabling so that there is enough freedom of movement to move the microphone into the needed locations. A small tripod stand is supplied with the UMIK-1, but a larger stand with boom arm can be used if desired. If necessary a USB extension (up to a total USB cable length of 5 meters) can be used. In larger spaces, an active USB repeater may be needed. We recommend that the microphone be oriented vertically (pointed at the floor or ceiling) and the “90 degree” calibration file used (see Mic Config tab below).

3.3 CONFIGURING FOR MEASUREMENT

Start **Dirac Live Calibration Tool For miniDSP**.

Ensure that no other programs are running that may attempt to communicate with the DDRC-88A, such as the **DDRC-88A Utility** program, as this may result in communication conflicts and errors.

Logo and status progress bar

This area shows a progress bar with current status when the program is performing calculations. If the program seems unresponsive at any time, check the status here.

Screen selection tabs

Each tab selects the information shown in the main display area. These are generally worked through in order, from top to bottom. This section covers the first four tabs; the final two are covered in Filter Design.

Load and save a project

A set of measurements can be saved to a file and reloaded at a later time. See Saving and loading projects.

Back to previous / proceed to next

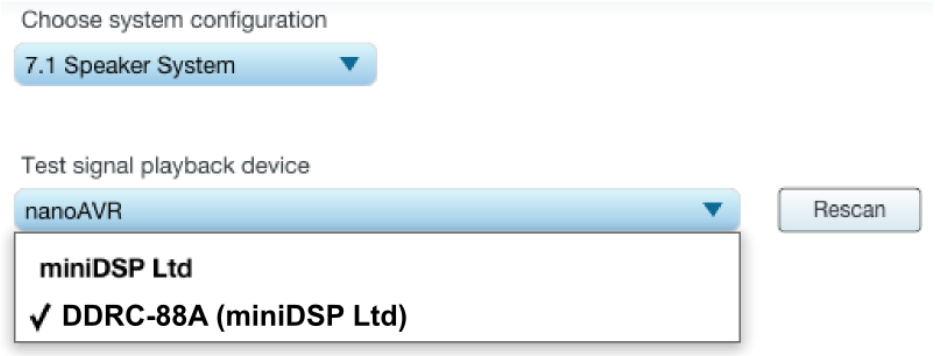
Use these two buttons to advance to the next tab when each is complete, or to go back to the previous tab to make alterations. The tabs at the left can also be clicked on directly.

Help open/close

Click on the small Help divider at the right of the screen to open a pane with help on the currently selected tab. Click on the divider again to close the help pane.

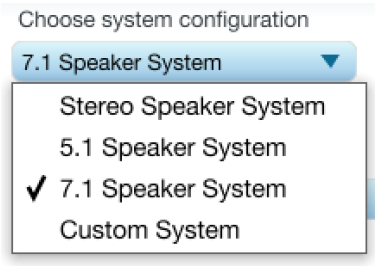
3.3.1 Sound System tab

On the **Sound System** tab, set the following parameters.



Choose system configuration

Use the dropdown menu to select your system configuration. For multi-channel use, usually **5.1** or **7.1** will be selected. If you have a system configuration other than 5.1 or 7.1, use the Custom System option (see Custom System configuration below).



Test signal playback device

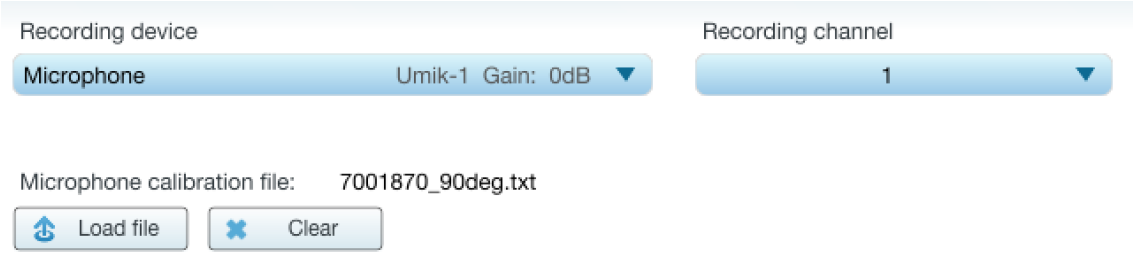
Preset to **DDRC-88A (miniDSP Ltd)**. This will ensure that test signals are sent into your audio system via the *DDRC-88A* processor.

If the **DDRC-88A** is not showing, check that your *DDRC-88A* processor is connected via USB and powered on, click the **Rescan** button, and then use the drop-down menu to select **DDRC-88A**.

Once you have verified that this tab is correct, click the **Proceed** button.

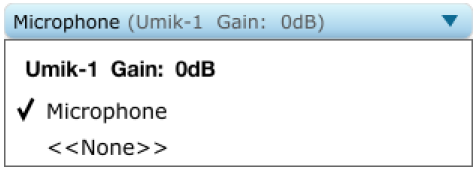
3.3.2 Mic Config tab

On the **Mic Config** tab, set the following parameters.



Recording device

Preset to the **UMIK-1**.



If UMIK-1 is not showing, ensure that the UMIK-1 is connected securely to the computer via USB, and go back to the **Sound System** tab and click on **Rescan**. Then use the drop-down menu to select the "Microphone" item underneath "UMIK-1".)

Recording channel

Select **1** from the drop-down menu.

Microphone calibration file

Each UMIK-1 measurement microphone is individually calibrated to ensure accuracy. To download the unique calibration file for your microphone, go to the UMIK-1 page and enter your microphone's serial number. It is in the form xxx-yyyy and labelled on the microphone. Ensure that you download both the regular calibration file and the "90-degree" calibration file. (The latter is generated specifically for use with miniDSP's multi-channel Dirac Live® processors such as the *DDRC-88A* and the *nanoAVR DL*.)

Then click on the **Load File** button and select your calibration file.

For home theater applications, it is best to use the 90-degree calibration file as this is created specifically for the vertical microphone orientation. This file is downloaded with the suffix "_90deg" in the file name.

Once you have verified that this tab is correct, click the **Proceed** button.

3.3.3 Output & Levels tab

On the **Output & Levels** tab, set **Output volume** quite low. If you have another volume control "down-stream" of the DDRC-88A, set it about halfway and increase it later if needed.

Click on the **Test** button for the left channel and gradually increase the output volume until it is at a moderate level, such that your voice would have to be raised to converse with someone sitting next to you.

Increase the **Input gain** slider until the blue bar on the level meter reaches up into the green section:

Click again on the **Test** button for the left channel to stop the test signal. Then click on the **Test** button for each of the remaining channels.

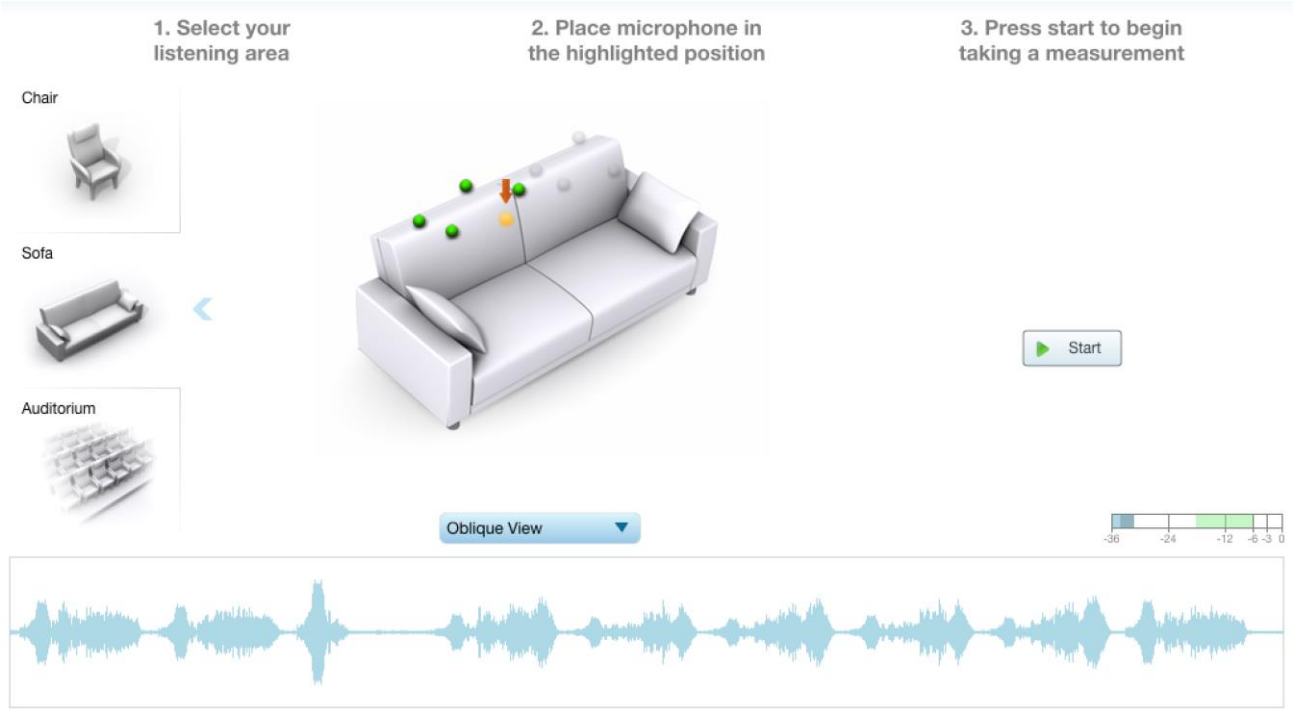
When done, click the **Proceed** button.

3.4 CUSTOM SYSTEM CONFIGURATION

(In preparation.)

3.5 RUNNING THE MEASUREMENTS

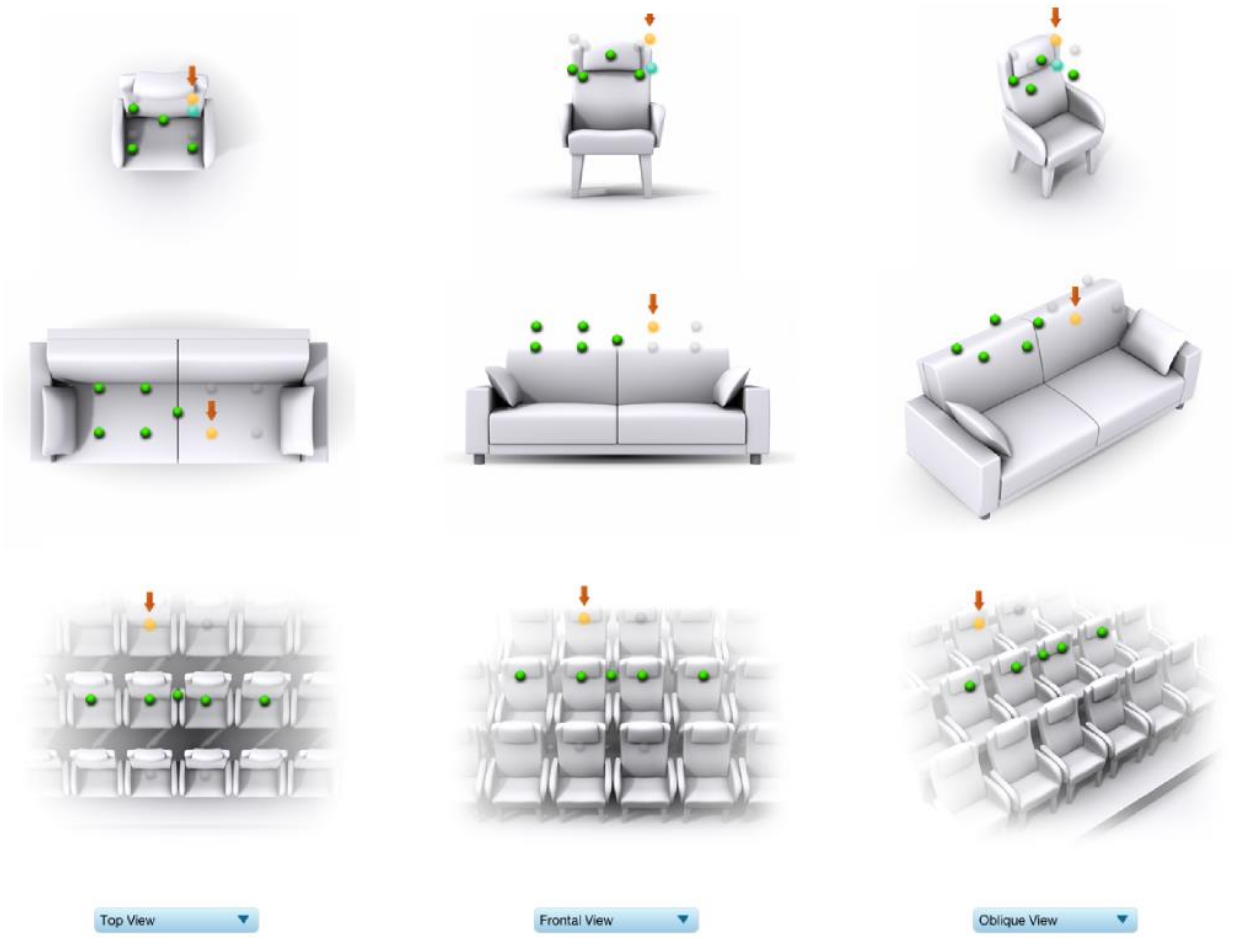
Measurements are performed on the **Measurements** tab.



3.5.1 Listening environment

The **Measurements** tab presents three different listening environments as a visual guide to positioning the microphone for each of the nine measurements: **Chair**, for a single listening seat; **Sofa**, for multiple listening seats; and **Auditorium**, for a large dedicated home theater or larger venue with staggered seating. Use the icons at the left of the screen to select the listening environment.

The center of the screen contains a pictorial representation of the selected listening environment, with dots marking the recommended microphone locations. Completed measurements are shown in green, while the next measurement to be done is highlighted in yellow and has a red arrow marker pointing to it. A drop-down menu underneath selects three different views, which should be used to help you place the microphone in the correct location.



It is important that measurements are performed over a sufficiently broad area. If the measurement area is too small, the result may be over-correction that will sound dry and dull. If using the **Chair** listening area, spread the microphone positions over a circle with a diameter of at least a meter (three feet). The microphone should be varied in height from the central position by at least 30 cm (one foot) up and down. If using the **Sofa** or **Auditorium** listening environment, spread the measurement locations over the full listening area and ensure that microphone height varies by at least 30 cm (one foot) up and down.

While the locations indicated are recommended, you can use a different set of locations if necessary. The important thing is to ensure that the measurement locations are spread over the whole listening area and that the microphone is moved a sufficient distance vertically as well as horizontally.

In some cases, such as when the listening area is very close to the loudspeakers, the size and in particular the height of the measurement area can be reduced, to avoid discrepancies caused by varying output response from the speakers themselves.

3.5.2 Executing measurements

With the microphone in place at the central location and pointed vertically (that is, towards the ceiling or floor), click on the **Start** button. The *DDRC-88A* HDMI audio processor will generate a test signal, audible as a frequency sweep through the left speaker, then the right, and so on through all channels, including the subwoofer. Finally, the frequency sweep plays through the left speaker again.

While the measurement proceeds, the time-domain response graph of the captured audio signal is displayed at the bottom of the measurement tab. (This graph is related to the magnitude response but is not the same display. Its purpose is to verify that the recorded signal level is in a suitable range.)

At the completion of the measurement, the status bar will update with a progress indicator as the program performs calculations on the measurement. If the measurement was successfully captured, the red arrow marker will advance to the next location to be measured.

If the program indicates that the measurement was not successful, you will need to take corrective action. The most common error is related to signal level:

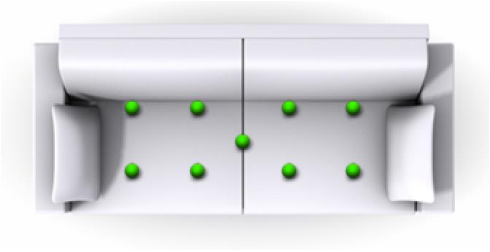
- The measurement signal is too low to ensure a clean capture.
- The measurement signal is too high and the audio signal has exceeded the maximum level (clipping). This is shown in red on the signal graph.

In either of the above cases, go back to the **Output & Levels** tab and adjust the output volume or microphone input gain. Then re-run the measurement. (You do not need to redo the measurements you have already successfully completed, even if you change volume or gain.)

3.5.3 Completing the measurements

After each successful measurement, the location marker (red arrow) will advance to the next location. Move the microphone to that location, using the three views (top, front, oblique) as a guide to positioning it in the correct location. Then click on **Start** again. Repeat this process until all nine locations have been successfully measured.

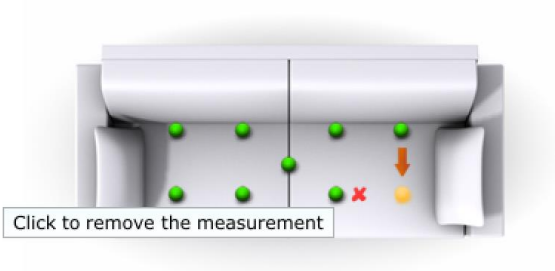
Note: it is good practice to save the project periodically while performing measurements (see Saving and loading projects below).



3.5.4 Viewing and redoing measurements

Click on the green dot for any completed measurement to display its measured time-domain response graph.

After clicking on a green dot, a small red "X" will appear next it. Click on the "X" to delete the measurement. The status bar will indicate that the program is recalculating parameters.



To redo a measurement, delete it, move the microphone to the appropriate location, and click on **Start**. Note: if more than one measurement is deleted, the marker will move to the lowest-numbered one.

It is important that all nine measurements are completed in order to ensure best results from the optimization algorithm. Being patient and thorough will pay audible dividends!

Once all nine measurements have been successfully completed, click the **Proceed** button.

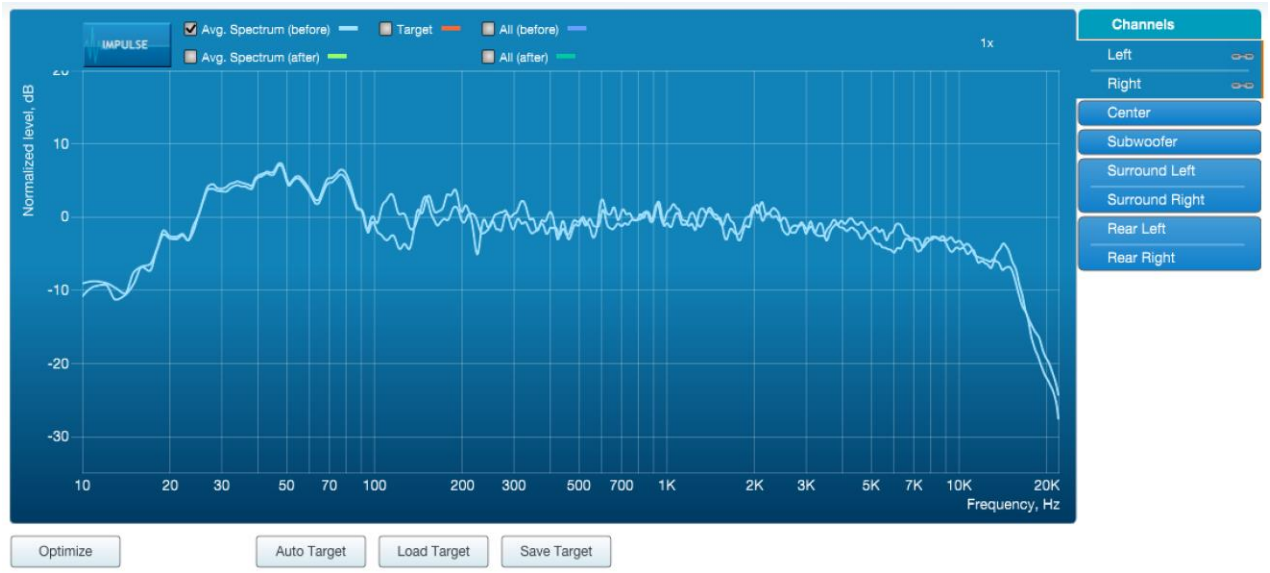
3.6 SAVING AND LOADING PROJECTS

Each set of measurements and the associated configuration settings are called a *project*. The project should be saved at regular intervals by clicking on the **Save** button. The default location for project files is **My Documents\MiniDSP\Projects**.

A project can be reloaded at any time by clicking on the **Load** button. This enables you to generate new correction filters for different target curves at a later date (see Filter Design), or to redo any of the measurements. (Note: if you wish to change between the **Chair, Sofa**, or **Auditorium** listening environments, you will need to start a new project.)

4 FILTER DESIGN

The **Filter Design** tab shows sets of graphs for the various 7.1 channels, selected using the tabs at the – click on these to display the response graphs for other channels (center, subwoofer, and surrounds). For each set of graphs, a number of variants can individually be turned on and off with the checkboxes above the graphs.



Avg. spectrum (before)

The average of the measured magnitude responses. These plots are shown in light blue.

Avg. spectrum (after)

The predicted average magnitude response after correction. These plots are shown in green, and can only be viewed after filters have been generated with the **Optimize** button.

Target

The target curve – that is, the desired in-room magnitude response. This curve is user-adjustable so you can fine-tune it to best suit your speakers, room, and preferences. See Designing your target curve below.

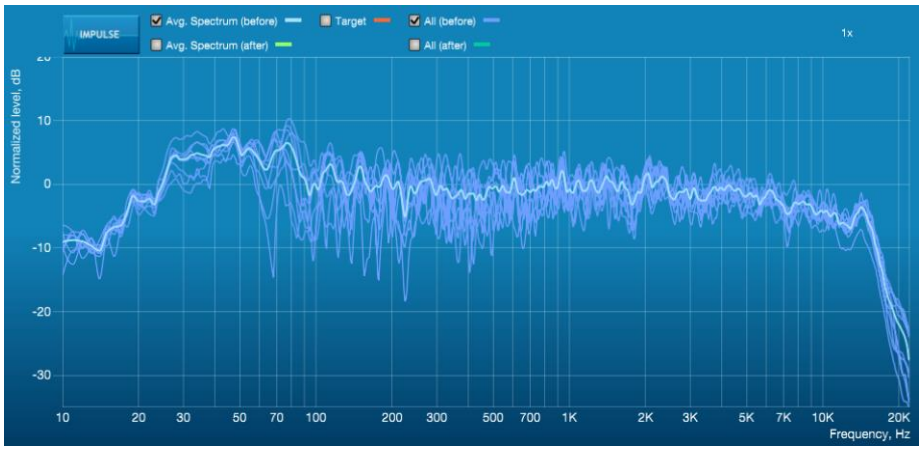
All (before)

All of the measured magnitude responses. These plots are shown dark blue.

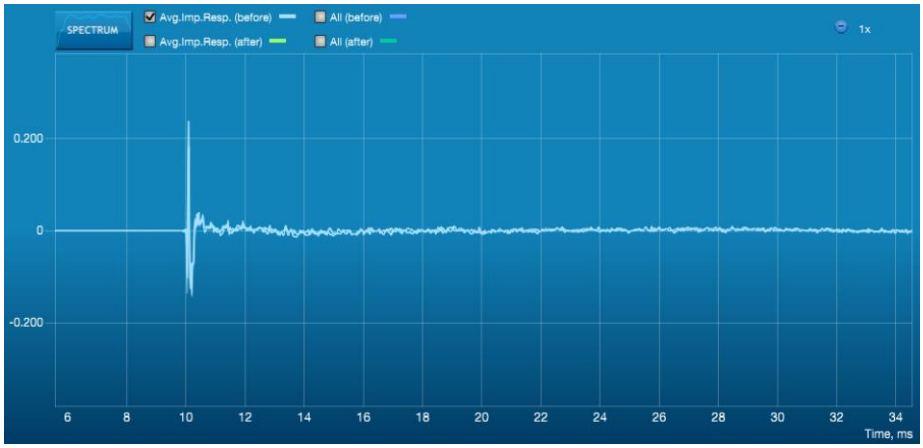
All (after)

The predicted magnitude responses after correction. These plots are shown in dark green, and can only be viewed after filters have been generated with the **Optimize** button.

The graphs showing all nine measurements are useful for seeing how much variation there is across the listening area:



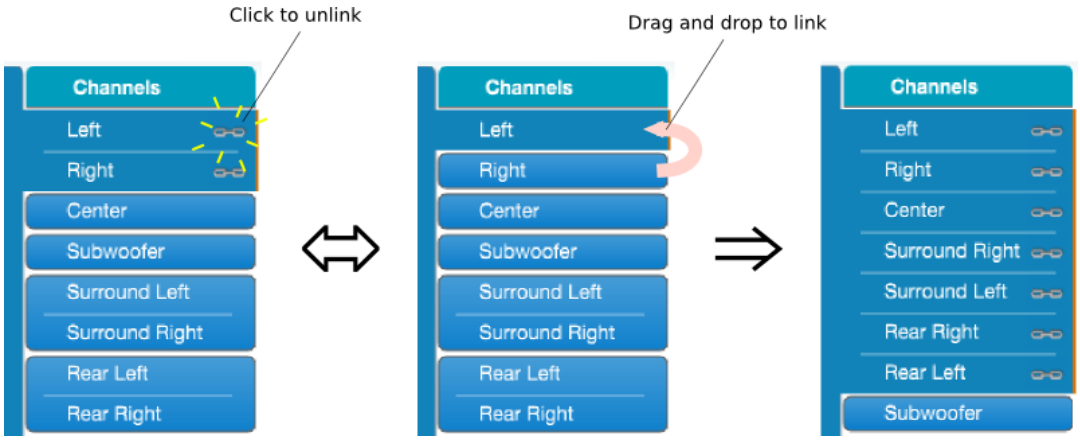
To display the impulse response instead of the magnitude response, click on the **Impulse** button at the top left of the display. As with the magnitude response, the average measurement can be shown as well as all nine measurements. The predicted responses after correction can be viewed after filters are generated with the **Optimize** button (see Generating correction filters below).



To return to the magnitude response, click on the **Spectrum** button.

4.1 WORKING WITH GRAPHS

Initially, the left and right front channels are shown. Some channels are linked together, as indicated by the small “chain” icons on the tabs at the right of the graph. When channels are linked, their graphs display together, and they share the same target curve – see Designing your target curve below. By default, the front left and right, surround left and right, and rear left and right channels are linked.

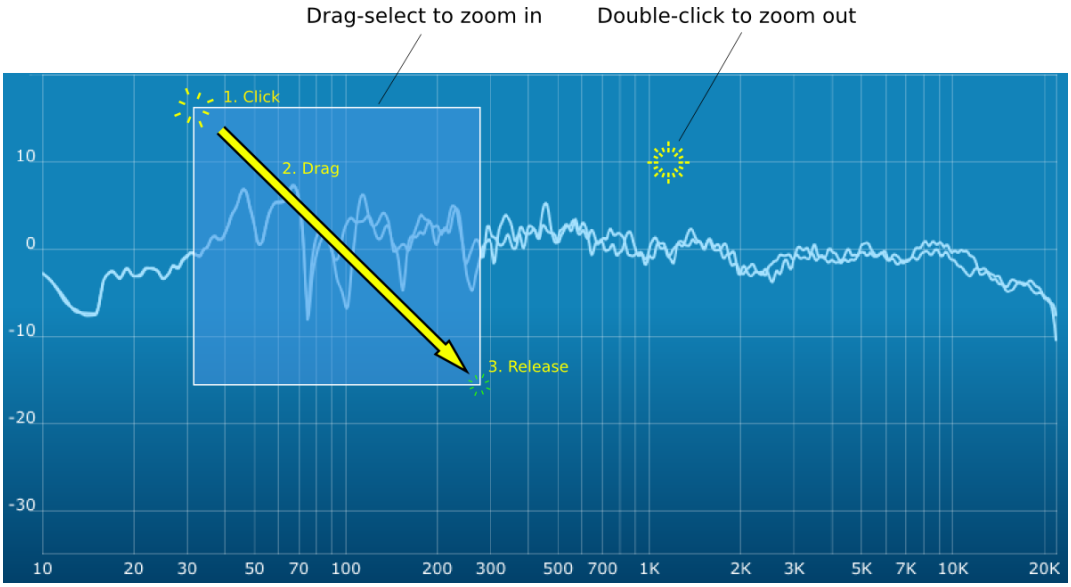


To unlink a channel, simply click on its chain icon. It will then be unlinked from the other channels. To link it to another channel or groups of channels, simply drag its tab on top of the channel or group of channels that you want it linked to.

Initially, you may wish to link all speaker channels together, as shown at right in the diagram above, as this will make it easier to experiment with target curves. Once you are up and running with filter sets, you can experiment with different target curves for different speaker sets.

The response graphs can be viewed at a larger scale. To zoom in and out:

- Drag-select a region of the graph to zoom in on it. (Click the left button, move the mouse while holding the button, release the button.) You can then drag-select a region again to zoom in further.
- Double-click on the graph to zoom back out to the previous zoom level, or click on the small "–" sign next to the zoom indicator at the top right of the display.



4.2 DESIGNING YOUR TARGET CURVE

The *target curve* is the desired in-room frequency response with the *DDRC-88A* processor performing digital room correction.

4.2.1 The Auto Target

When first viewing the **Filter Design** tab, an estimated target curve suitable for your speakers is shown as the red curve. This calculated target curve can be restored at any time by clicking on the **Auto Target** button.

Note: restoring the auto target will erase the current target curve. If you wish to keep it, you can save it to a file – see Saving and loading target curves below

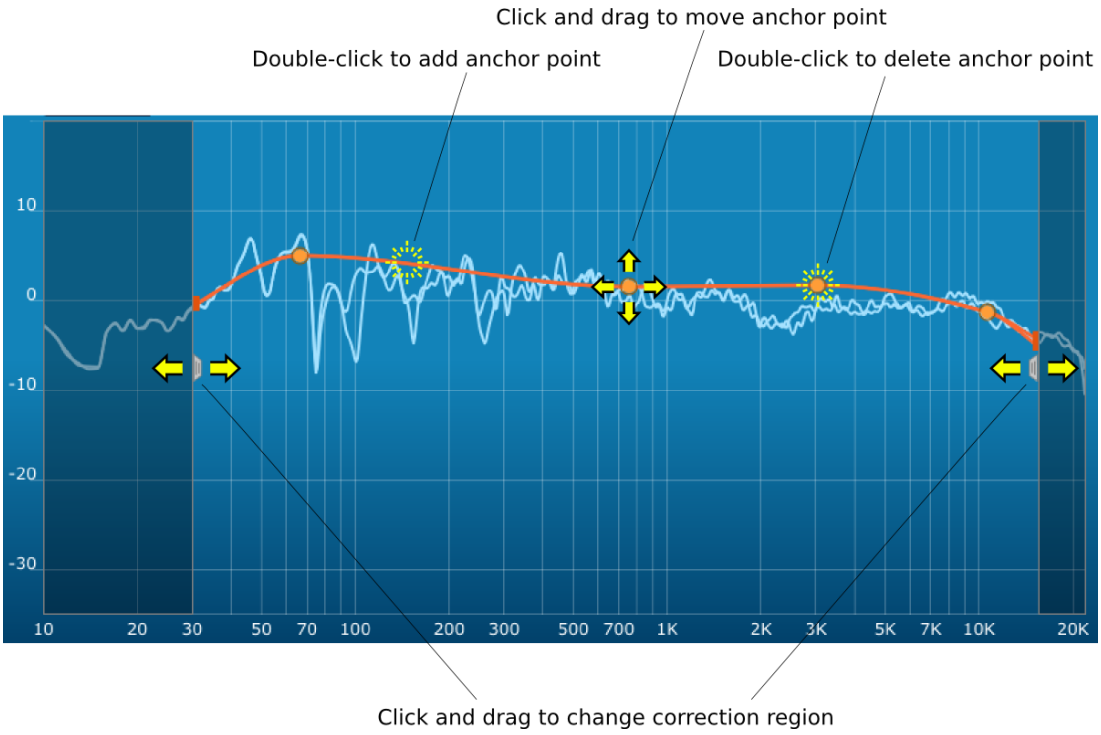
4.2.2 Editing the target curve

You can edit the target curve to set any desired magnitude response (see Guidelines for target curve design below). This is done with the use of *anchor points*, shown as orange dots on the curve:

- Drag an anchor point to move it.
- Double-click on the target curve to add an anchor point.
- Double-click on an anchor point to delete it.

The regions to the left and right of the response graphs that are shaded in a darker color are excluded from magnitude response correction. You can adjust the frequency range for your system and preferences. For example, low-frequency noise (traffic, machinery) may be present in some environments, so it is best to adjust the frequency range to exclude these frequencies from the correction. Or, you may be happy with the in-room response at higher frequencies, so you can set the frequency region to limit correction to the modal region (up to 300 Hz, in a typical room).

To alter the frequency region, drag the grey handles on either side of the graph. Note that you can't drag these handles over an anchor point, so you may need to move or delete an anchor point that is "in the way."



If channels are linked, the same target curve is used for that group of linked channels. To create a separate target curve for a single channel, unlink it as described above in Working with graphs.

4.2.3 Guidelines for target curve design

Care should be taken to create a target curve that works well with your speakers and room, as well as suiting your personal preferences. Small changes to the target curve can have significant effects on the tonal quality of the system, so it is important that you experiment with different target curves to find the optimum.

If you initially don't achieve a satisfactory result, please ensure that you have spread your measurements over a sufficiently large area and with sufficient variation in height. The following guidelines will help you understand how to adjust your target curve.

Low-frequency extension and boost

All loudspeakers have a natural low-frequency roll off. Setting the target curve to boost the region below the speaker's natural roll off frequency *may* result in overdriving the speakers, especially with smaller home theater loudspeakers and depending on your listening habits. As a general rule, a home theater system should use bass management in the receiver to direct low frequency content to the subwoofer.

The auto-target estimates the low-frequency roll-off and curve. You should determine by listening whether this estimate is suitable for your system, and adjust the target curve accordingly.

High-frequency "tilt"

The target curve is the desired measured response of loudspeakers *in a room,* In contrast to measurements made of a loudspeaker during its design under anechoic (measured in free space) conditions. While high-quality loudspeakers are usually designed for a flat on-axis anechoic response, these same speakers when placed into a listening room will tend to have a downward-sloping or "tilting" response at high frequencies, due to the effects of limited dispersion at high frequencies and greater acoustic absorption.

A completely flat in-room response is therefore usually not desirable and will tend to sound thin or bright. Start with a target curve that follows the natural behavior of your speakers in your room, and then experiment with greater or lesser degrees of tilt in the treble region to obtain the most natural timbral balance.

Low-frequency adjustment

A completely flat response at low frequencies, with complete elimination of peaks due to room modes, may sound light in the bass. Often, a slight increase in the target curve below 100 Hz will give a more balanced sound, yet without introducing audible irregularities in bass response.

Magnitude response dips

In some cases, it may be helpful to adjust the target curve to follow dips in the magnitude response. This can occur where, for example, the listening area is very close to the speakers and the measurements exhibit a dip caused by the vertical response of the speakers themselves. In such a case, adjusting the magnitude response to follow the dip will avoid making the speakers sound worse elsewhere in the room. (You may also wish to try a different set of measurement locations.)

Unlinking channels

Usually, the corresponding left and right channels (front left and right, surround left and right, and rear left and right) should remain linked for target curve adjustment, to ensure that both sides produce the same response across the listening area. In certain unusual circumstances, such as where the magnitude response dip discussed in the previous point shows up on only one side, you can try unlinking channels and making separate adjustments.

4.2.4 Saving and loading target curves

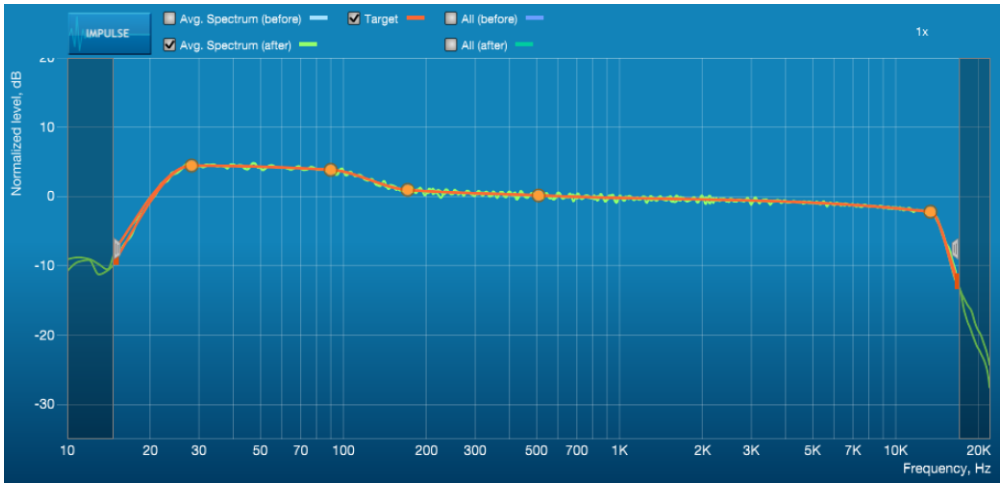
To allow you to experiment with different target curves, you can save a target curve to a file and reload it at a later time. The default directory for these is **C:\Users\[User]\AppData\Roaming\Dirac\OEM\MiniDSP\Targets**, but you can store them in any location in your file system. To save the target curve of the currently displayed channel or group of channels, click on the **Save Target** button.

To load a target curve, click on **Load Target**. The currently displayed channel or group of channels will have its target curve updated. (Loading a target will erase the current target curve, so be sure to save it first if needed.)

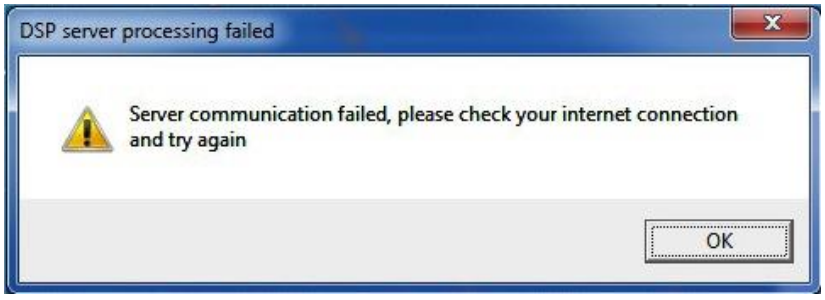
4.3 GENERATING CORRECTION FILTERS

Once you have a target curve set to your satisfaction, click on the **Optimize** button.

The status bar will update as the algorithm progresses. The entire algorithm may take some time to complete, depending on the speed of your computer. When the algorithm completes, the predicted average magnitude response will be shown in green. (The predicted impulse response can be viewed by clicking on the **Impulse** button.)



The **Dirac Live Calibration Tool For miniDSP** will contact the Dirac license server to verify its license, so you will need to be connected to the Internet to perform this step. If a firewall is in place, it must allow HTTP (normal web traffic) to pass. Otherwise, an error such as the following may appear:

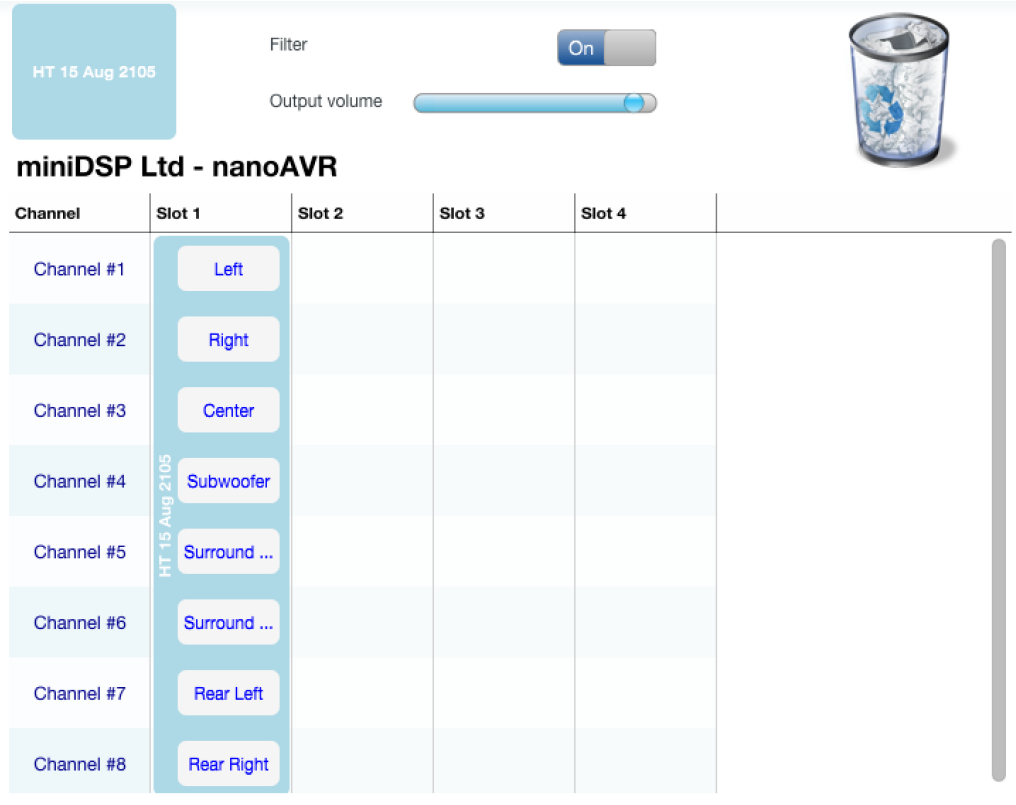


Once the filters are generated, click the **Proceed** button.

4.4 DOWNLOADING AND MANAGING FILTER SETS

The **Export** tab initially shows four empty "slots" for filter sets (a filter set is one filter for every channel). Filter sets are managed with a "drag and drop" metaphor:

- To load the most recently generated filter set into the processor, drag the box at the top left (labeled "Auto target" in the example) and drop it onto an empty slot.
- To remove a filter set, click on its name (oriented vertically), drag it from the slot and drop it on the trashcan icon at the top right.
- To load a filter set into a slot that already has filters loaded, first delete the loaded filter set by dragging it onto the trashcan icon. Then drag and drop the current filter set onto the now-empty slot.



The two main controls on this tab are:

Filter

Turn this on to enable the Dirac Live® correction filters.

Output volume

Move the slider to adjust the output volume of the processor. Once the computer is disconnected, output volume can also be adjusted by an infrared remote control.

5 USING THE DDRC-88A AUDIO PROCESSOR

Once the desired correction filters have been downloaded into the *DDRC-88A* audio processor, the computer is not required and can be disconnected. The front panel and/or an infrared remote can be used to control:

- Filter set selection
- Master volume
- Master mute (remote control only)
- Dirac Live® filtering bypass (remote control only)

5.1 STATUS INDICATORS

The current status of the DDRC-88A is indicated by a set of LEDs:

Dirac Live Dirac Live® filtering is enabled.

Filter Set Indicates the currently selected filter set (1 through 4).

5.2 FRONT PANEL CONTROLS

The DDRC-88A audio processor uses a minimalist physical control design with a single control knob.

To change the volume

Rotate the control knob clockwise to increase the volume, and counter-clockwise to decrease it.

To change the selected filter set

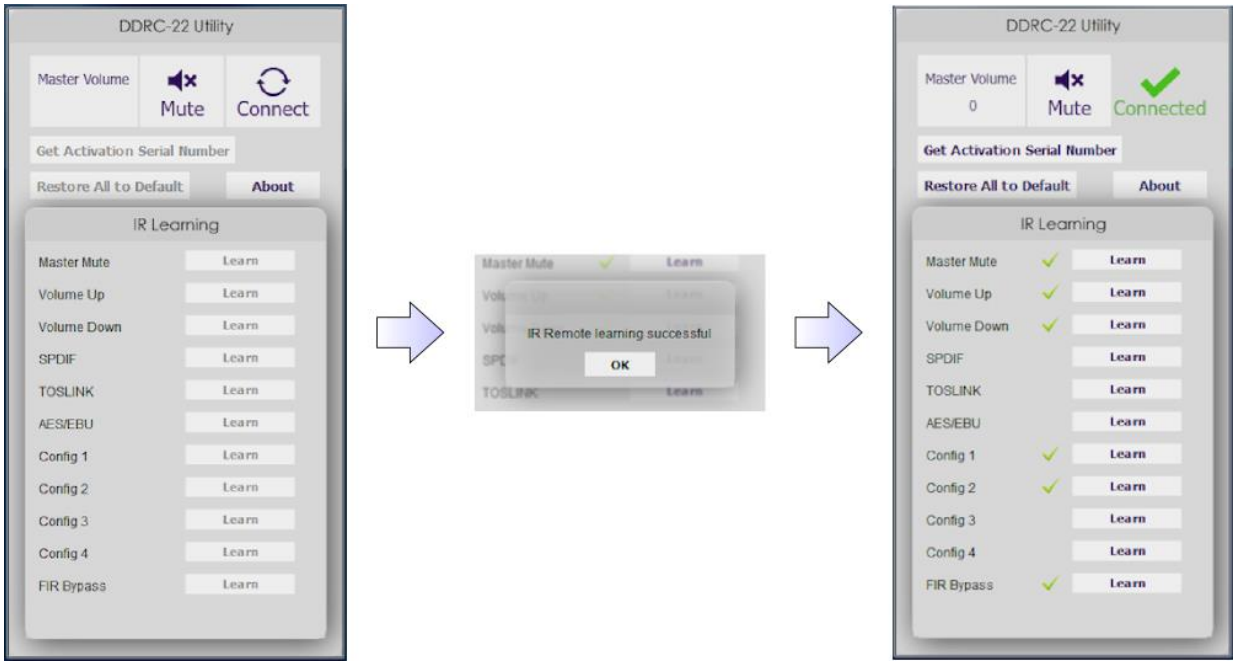
Briefly press the control knob. The **Filter Set** LED blinks quickly. Rotate the control knob until the desired filter set LED is blinking. Press the control knob again, and the selected LED will remain steady.

5.3 INFRARED REMOTE CONTROL

Many standard and programmable remote control units can be used with the DDRC-88A processor. Instead of adding another remote to your collection, the processor can "learn" the control codes of your current infrared (IR) remote if it supports one of the following remote control codes:

- NEC
- Sony
- Philips RC6
- Apple Remote

Learning is done with the **DDRC-88A Utility** program. After starting the program, click on the **Connect** button. To initiate learning, simply click on one of the function buttons in the **IR Learning** box (**Master Mute**, **Volume Up**, and so on). Then point your remote at the processor and click on the button that you want to use for that function. A dialog will appear to show that the code was recognized. (If the processor does not recognize the remote control code, then it will time out and display a message saying that no IR code was detected.)



Once programmed, check that the programmed buttons perform the expected function. (Note that changing the filter set with the remote will cause the **DDRC-88A Utility** program to disconnect.)

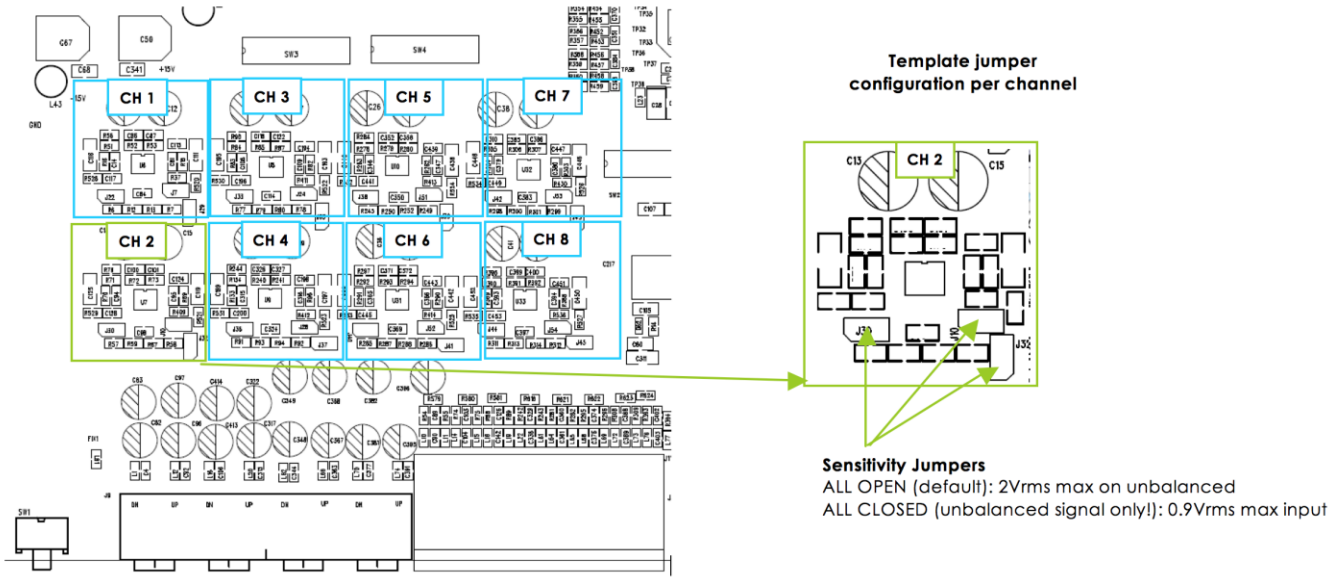
6 OPTIMIZING GAIN STRUCTURE

When deploying a DSP solution in your audio system, a topic that becomes more important than with analog equipment is *gain structure*. This means that the signal levels throughout the system should be set to an optimum – high enough to maximize digital resolution and minimize noise, but not so high as to result in clipping and distortion.

6.1 INPUT SENSITIVITY

By default the input sensitivity of the DDRC-88A is 2 VRMS on the single-ended inputs. This is the signal level that will result in a full-scale digital signal from the input ADC (analog-to-digital convertor). For typical components with a specified 2 VRMS output level, the default setting will work well. In some cases, higher

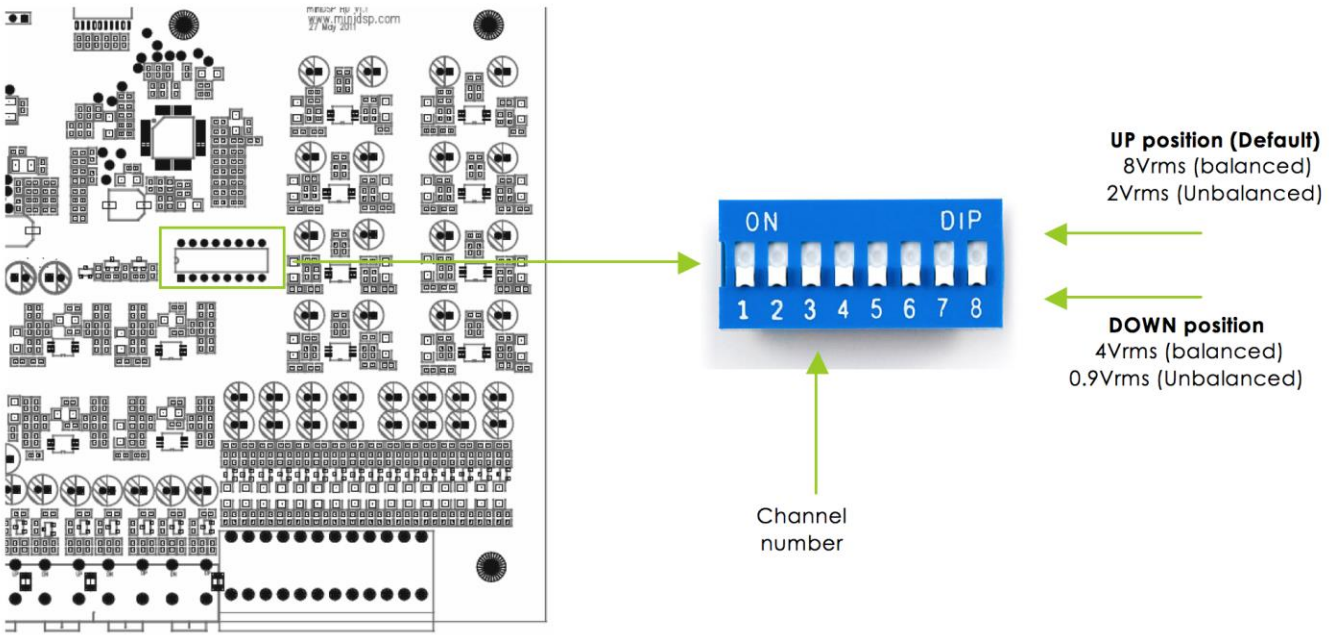
In same cases, a higher input sensitivity may be required, when connected to a component that produces a lower signal level (such as a portable audio player or a phono preamp). This can be accomplished for the single-ended inputs by adding a set of jumpers to each channel, as shown here:



The balanced connection **cannot** be used on any channel with the jumpers set to the 0.9 VRMS position. Use the jumpers only if making the connection to the RCA jack.

6.2 OUTPUT GAIN

By default, the maximum output signal level of the DDRC-88A is 2 VRMS on the RCA jacks, and 8 VRMS on the balanced connectors. These levels are compatible with the majority of consumer and pro-audio equipment respectively. If, however, a lower output level is required on any channel, the output gain can be reduced to 0.9 VRMS and 4 VRMS with the use of a DIP switch on the circuit board, as shown here:



7 ADDITIONAL INFORMATION

7.1 SPECIFICATIONS

Computer connectivity	Driverless USB 2.0 control interface for Windows and Mac OS X
Analog inputs	8 x Balanced (Terminal Block) or 8 x Unbalanced (RCA) inputs • Maximum balanced input voltage: 8 VRMS • Maximum unbalanced input voltage: 2.0 or 0.9 VRMS (jumper selectable)
Analog outputs	8 x Balanced (Terminal Block) and 8 Unbalanced (RCA) outputs • Maximum balanced output voltage: 4.0 or 8.0 VRMS (DIP switch selectable) • Maximum unbalanced output voltage: 2.0 or 0.9 VRMS (DIP switch selectable)
Audio sample rate / Resolution	Input/output resolution: 24-bit integer Sample rate: 48 kHz
Audio processing	32-bit floating-point processor
Storage/Presets	4 filter sets stored, selectable from front panel or IR remote
Infrared remote	"Learning remote" capabilities (NEC, Philips, Sony, Apple) Controls master volume, mute, filter set selection, Dirac Live® filtering enable
Power supply	12 VDC single supply
Dimensions (H x W x D)	41.5 x 429 x 252 mm; 1RU height

7.2 TROUBLESHOOTING

The following table lists the most common causes of issues with the DDRC-88A. If following this table does not provide a solution, see Obtaining Support below.

Item#	Symptoms	Troubleshooting recommendation
1	Cannot install software	a. Confirm that you downloaded and installed the required frameworks first (see Software Installation).
2	The Dirac activation screen does not recognize the serial number	b. Do not use the serial number printed on the label of the unit. You must use the serial number obtained from the firmware using the **DDRC-88A Utility** program.

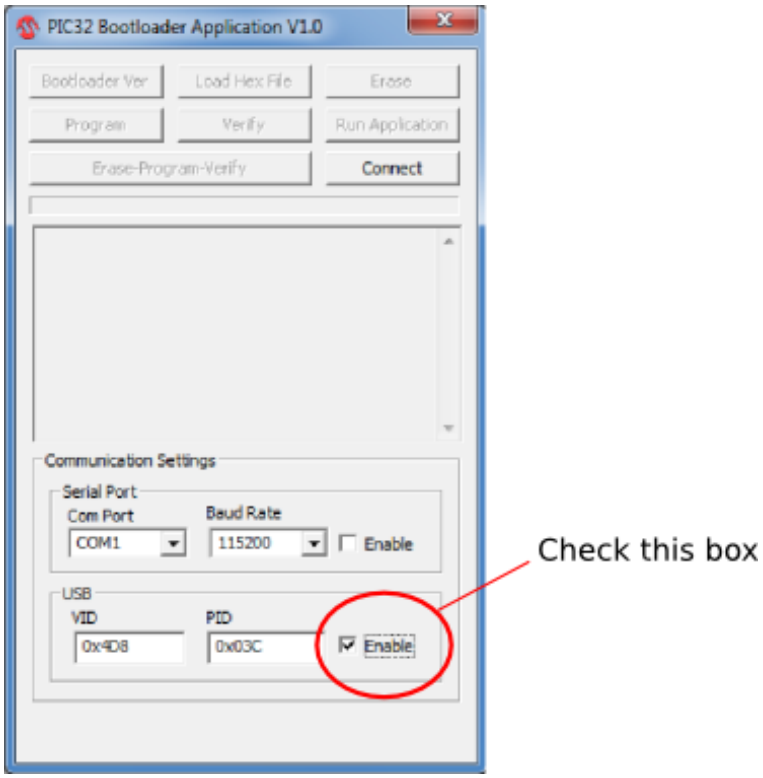
3	The license validation screen doesn't accept my username and password	c. The "username" must be the **email address** that you used when activating your license on the Dirac Live activation screen. Check that you are using the same email address and password.
4	The DDRC-88A doesn't appear in the **Sound System** tab	d. Check that the USB cable to the DDRC-88A is firmly connected. e. Check that you do not have any other program running that is attempting to communicate with the DDRC-88A, such as the **DDRC-88A utility** program. f. Check that you have the miniDSP version of the software installed, called **Dirac Live Calibration Tool For miniDSP**. g. Go to the **Sound System** tab and click the **Rescan** button.
5	The measurement test signal produces no output	a. Ensure that the *DDRC-88A* processor is connected correctly into the audio system. b. Check that the downstream amplification is powered on. c. Check that the downstream amplification is not muted and/or doesn't have level controls set to zero.
6	No input from measurement microphone	a. Check that the USB cable to the UMIK-1 is securely seated. b. Check that the UMIK-1 is selected in the **Mic config** tab.
7	Insufficient recording level	a. Increase microphone level in the **Output & Levels** tab. b. Go to the Control Panel and view the Recording tab of the Sound pane. Select the UMIK-1 and view its Properties. In Levels, set the gain to 100. c. Increase system output volume.
8	Unable to generate correction filters (**Optimize** button)	a. Check that your computer is connected to the Internet and able to pass HTTP (web) traffic. b. Check that you do not have any other program running that is attempting to communicate with the DDRC-88A, such as the **DDRC-88A utility** program.
9	No audio playthrough	a. Check that the DDRC-88A processor is not muted. b. Check that the DDRC-88A processor master volume control is not turned down. c. Check that all cables are securely seated. d. Check that cables are plugged into the correct inputs and the correct outputs. e. Check that the source equipment is not muted. f. Check that the source equipment does not have volume set to zero.

7.3 MCU FIRMWARE UPGRADE

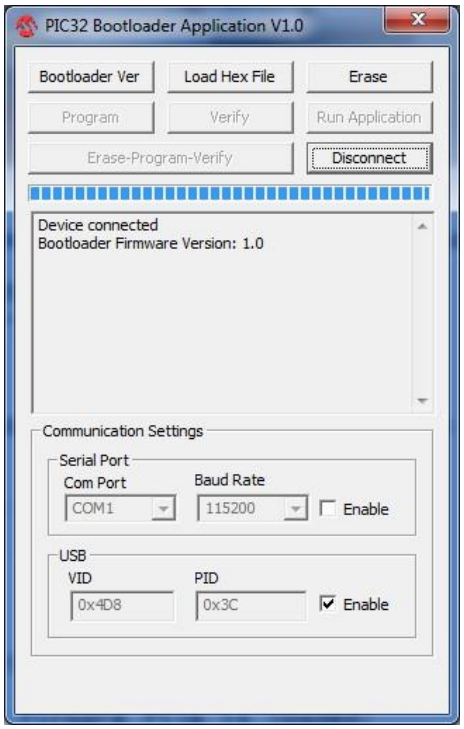
miniDSP may periodically provide an update to the DDRC-88A MCU firmware to enable new features. To update the MCU firmware, download the latest version of the **DDRC-88A configuration plugin** from the User Downloads section of the miniDSP.com website. Unzip the download and run the installer. Then follow the steps below.

Note that the firmware upgrade tool is, as of publication of this User Manual, available on Windows only.

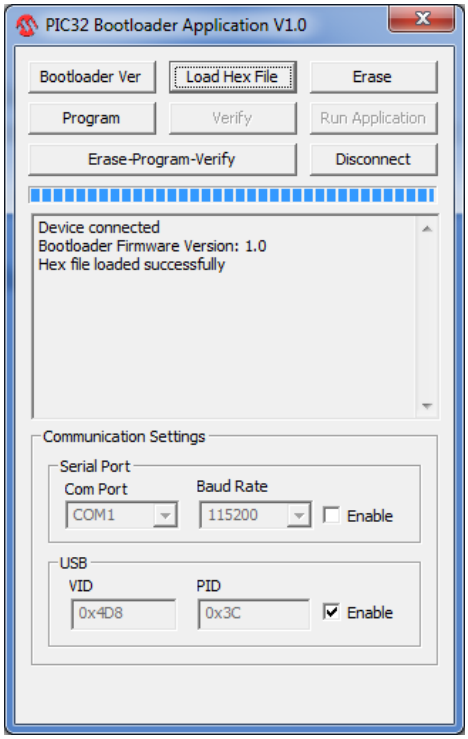
1. Unplug DC power from the DDRC-88A.
2. Connect the DDRC-88A to your PC using the USB cable.
3. Press and hold the reset button and plug in the power cord.
4. Release reset button. Verify that only Preset 1 LED is blinking and all other LEDs are off.
5. Navigate to the directory **C:\Program Files (x86)\miniDSP\DDRC-88A\firmware_tools\Windows** and run the program **PIC32UBL**.
6. Check the Enable checkbox in the USB pane near the bottom of the window.



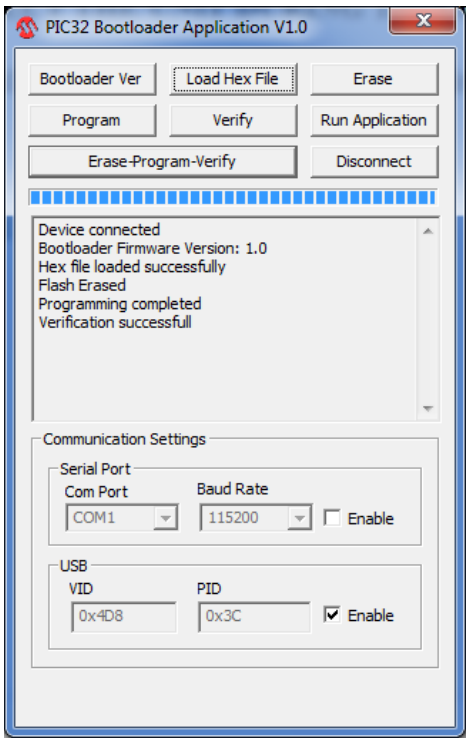
7. Click on the **Connect** button. The status display should change to show that the program has connected:



8. Click the **Load Hex File** button. Browse to the firmware file located in the unzipped download and select it. The file will have name like **DDRC_88A_v1_17_Released_13Nov2014.hex**. The status will show that the hex file has loaded successfully:



9. Click the Erase-Program-Verify button. The progress bar will update. After some time, the status will update to show successful completion.



DO NOT DISCONNECT THE USB CABLE OR POWER FROM THE DDRC-88A WHILE THIS IS IN PROGRESS. DOING SO MAY "BRICK" YOUR DDRC-88A.

10. Click the **Run Application** button to reboot the DDRC-88A.
11. Click the **Disconnect** button
12. Close the **PIC32UBL** application.

Provided firmware update was successful, you can now continue to use the DDRC-88A as before.

7.4 Obtaining Support

1. Check the forums on miniDSP.com to see if this issue has already been raised and a solution or solutions provided.
2. Contact miniDSP via the support portal at minidsp.desk.com with:
   a. The specific product you are having an issue with (in this case, DDRC-88A).
   b. A clear explanation of the symptoms you are seeing.
   c. A description of the troubleshooting steps (see Troubleshooting above) you performed and the results obtained.